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THE RETURN OF THE PULMOTOR AS A "RESUSCITATOR": A BACK-STEP TOWARD THE DEATH OF THOUSANDS[1]

By Professor YANDELL HENDERSON

YALE UNIVERSITY

IN no field of scientific activity during the past half century have the advances been greater than in that concerned with the saving of human lives. Yet along with some of these advances there have been very considerable amounts of charlatanism; quackery and their inevitable consequence—increase of mortality. Fortunately what was false and harmful has generally been, after a time, exposed and rejected; but not always or soon. And now a particularly evil affair has developed: that of a device that thirty years ago was introduced as a life-saver, but that was shown to be rather a life-loser, and was therefore rejected; yet that now is again being exploited under another name with all the force of high-powered salesmanship and pseudo-science to the inevitable loss of many lives that could be, and should be, saved.

The device to which I refer is a breathing machine that at first was called a "pulmotor" and that now, slightly changed in form but identical in essentials, is being reintroduced under another name as a "resuscitator." By alternately sucking and blowing, these "pulmotor-resuscitators" were designed, and have been claimed, to remove poisonous gases from the lungs and

[1] For the evidence, experimental and clinical, and full references to the literature upon which this article is based, see: Henderson and Haggard, "Noxious Gases and the Principles of Respiration Influencing Their Action," 2d edition, New York, 1943; Henderson and Turner, "Artificial Respiration and Inhalation," *Jour. Am. Med. Asn.*, 116: 1508, 1941; Henderson, "Adventures in Respiration; Modes of Asphyxiation and Methods of Resuscitation," Baltimore, 1938; and same author, "Tonus and the Venopressor Mechanism: The Clinical Physiology of a Major Mode of Death," *Medicine*, 22: 223, September, 1943.

blood and to induce a return of breathing in cases of partial drowning, electric shock and gas asphyxiation. For this claim, no valid scientific evidence has ever been offered. The sole supporting argument for such suck and blow devices is a demonstration that, when one of them is attached to a rubber bag, the bag can be alternately inflated and deflated; and—more dramatically—that when an inflated rubber doll is substituted for the bag, the doll can be made to "breathe" realistically. On this basis, the claim is that, if the human lungs were similarly subjected to alternating positive and negative pressures, they would be similarly ventilated. Yet in reality they are not, unless the positive and negative pressures employed are so large as to induce mechanical injury, dangerous degrees of acapnia and failure of the circulation.

It is true that a healthy conscious man can voluntarily adjust his breathing to the rhythm of such apparatus, so that he appears to behave like the rubber doll. But if the patient is unconscious and the pressures applied, both positive and negative, are low enough to be harmless, there is generally either complete discordance between the patient's breathing and the rhythm of the apparatus; or else the well-known vagal reflexes from the lungs—which are lacking in a rubber doll—cause the diaphragm to resist the artificial respiration by contrary respiratory movements.

The inventors of the pulmotor assumed, and the promotors of "resuscitators" still claim, that by artificially forcing the lungs and chest through movements like those of breathing, a return of natural respiration should be induced. But, on the contrary, the far-reaching advances made during the past four decades in our knowledge of the physiological control and regulation of respiration have established the facts that the restoration and maintenance of respiration are principally dependent, not on the reciprocating reflexes of inspiration and expiration, but on the chemical stimulation of the respiratory center in the brain by the blood gases—particularly carbon dioxide, along with an adequate amount of oxygen. The argument for pulmotors and "resuscitators" implied by the rubber doll is that, just as a stalled gasoline motor in an automobile or motor boat can be restarted by cranking, so by analogous means a drowned or asphyxiated man, or an apneic newborn baby, should be resuscitated: which is in direct conflict with all that is known scientifically about resuscitation.

My own experience with carbon monoxide asphyxia began in 1910 when I was called to see a man who had been overcome in his bedroom by city gas and was under treatment with a pulmotor. He was not very deeply asphyxiated; but he was entirely unconscious and was breathing stertorously. What was most noticeable was that the rhythm of the apparatus was entirely out of step with the patient's own respiration, which it was rather opposing and impeding than aiding. However, in that case, consciousness returned after a time, as occurs in mild cases without any treatment; and recovery followed. Now, after the experience of thirty-two years and hundreds of cases far more efficiently treated, I can report a recent similar victim, not treated by me, who also was still breathing while a "resuscitator" clicked rapidly and ineffectively from blowing to sucking and sucking to blowing, wholly out of time and in conflict with the patient's own respiration. In that case, consciousness did not return, and the man died in coma a couple of days after the asphyxiation.

Carbon Monoxide Asphyxia

Unlike many other poisonous gases, carbon monoxide is not an irritant: even in amounts that are deadly, it does not directly injure the lungs, and may not appreciably diminish the percentage of oxygen in the air of the lungs. Instead, this gas combines with the hemoglobin, the red coloring matter and oxygen-carrying substance in the blood. Until it is largely displaced from the blood and the oxygen-carrying capacity of the blood thus restored, the tissues of the body, and particularly the brain, continue in a state of asphyxiation, that is, oxygen starvation. Accordingly, it was early realized that the only way that carbon monoxide can be displaced from hemoglobin is by the mass action of oxygen. But in practice, mere inhalation of oxygen alone often failed to resuscitate; and if the victims did not die in asphyxia, they sometimes survived as idiots or neurological cripples.

If then asphyxial damage to the brain is to be reduced to a minimum, it is essential that as large an amount of oxygen as possible shall be drawn into the lungs, and blown out again several times a minute for a half hour or more with continually fresh oxygen. This—as above stated—pulmotors and "resuscitators" were designed to do; but, owing to the fact that natural respiration will not cooperate with sucking and blowing machines, but rather opposes their action, they have proved incapable of accomplishing. Accordingly, the mortality induced by carbon monoxide poisoning in such cities as New York and Chicago—during what may be called the "pulmotor period" (1910–1922)—was not appreciably decreased from the "prepulmotor or oxygen inhalation period" (prior to 1910). A typical case of the deaths that were common in the "pulmotor period" was described in the *Journal* of the American Medical Association of March 8, 1912, page 738, by a competent witness, Dr. Morris Fishbein, now the editor of that journal, as follows: The patient "who had been poisoned with CO was subjected to the action of a pulmotor for

several hours. After nearly 5 days of unconsciousness, the patient died. At autopsy, hemorrhage into the lungs and visceral pleural emphysema (dilated areas) of the right lung were found, together with subpleural emphysema." In this and many similar cases it is particularly noteworthy that, as carbon monoxide is not an irritant gas, the condition of the lungs found at autopsy was clearly due mainly to the mechanical damage done by the sucking and blowing of the apparatus.

In the directions for the use of "resuscitators," which are supplied with the apparatus, it is stated that, if the patient is still breathing, or begins to breathe, the suck and blow action should be switched off and the inhalational action switched on. And this, little as the writers of those directions seem to realize it, virtually signs the death warrant of every deeply asphyxiated patient so treated. For this inhalation is given with a type of mask and valves such that much of the carbon monoxide that comes out of the lungs is re-inhaled and its elimination thus retarded. Neither in respect to artificial respiration by sucking and blowing nor by means of their inadequate inhalational attachment are the "resuscitators," now so actively promoted, capable of restoring natural breathing or eliminating carbon monoxide from the lungs and blood sufficiently rapidly, if the case is severe, to prevent serious and even fatal postasphyxial effects.

Resuscitation by Inhalation of Carbon Dioxide and Oxygen

Fortunately for the saving of life, that volume of lung ventilation which can not be produced by suck and blow machinery, without risk of serious harm, can be induced safely and with high efficiency by natural breathing when stimulated by inhalation of carbon dioxide. For when the requisite concentration (7 to 9 per cent.) of carbon dioxide is administered mixed with otherwise pure oxygen, so large a volume of breathing is induced and such a mass action of oxygen is brought to bear on the blood as it flows through the lungs that virtually all the carbon monoxide that has been absorbed is rapidly eliminated; and the asphxiation is thereby terminated.

Accordingly, in 1921, Henderson and Haggard introduced the method of resuscitation by inhalation of oxygen with enough carbon dioxide to induce a maximum minute-volume of respiration. After long and careful laboratory and clinical tests, they determined the conditions requisite for the most effective use of this mixture. These are (1) that it shall contain 7 to 9 per cent. of the stimulant carbon dioxide; (2) that the inhalator employed shall be capable of administering the maximum volume per minute that the patient can thus be stimulated to inhale; (3) that the inhalator shall not permit any rebreathing whatever; and (4) that the valves and bag shall be so arranged that the resuscitant gas flows to the mask only during inspiration; otherwise the supply may be exhausted before resuscitation is effected.

It should be emphasized also that the inhalator devised along these lines by Henderson and Haggard has never been patented, or its manufacture, sale and use limited in any way; it is free to any and all.

Manual Versus Mechanical Artificial Respiration

At nearly the same time (about 1912) that the pulmotor first appeared, the prone pressure method of manual artificial respiration was introduced by Professor E. A. Schafer, of Edinburgh. In order that there might be sound and authoritative evaluation of all methods, new and old, for artificial respiration, a Committee on Resuscitation from Mine Gases was appointed jointly by the U. S. Bureau of Mines, the American Medical Association, the American Red Cross and the National Electric Light Association; the predecessor of the Edison Institute. The members of this committee were W. B. Cannon, G. W. Crile, J. Erlanger, S. J. Meltzer and Y. Henderson; and as authorities on the conditions inducing death by electric shock, Elihu Thomson and A. E. Kennelly were added. All methods of artificial respiration known or proposed at that time (1912) were subjected to careful and prolonged experimental and clinical investigation by the members of the committee themselves.

The members of that first committee acted on a sense of responsibility for the preservation of human life: a moral sense not so evident in a more recent committee—the Council on Physical Therapy of the American Medical Association—which "accepts"—that is, approves—"resuscitators" on the basis of no personal investigation by any of its members—as admitted in their letters to me—other than the secretary, who is a mechanical engineer of no physiological training or medical experience.

The main point developed by the committee of 1912 in regard to manual methods of artificial respiration was, not that any one of them—whether Schafer, Silvester or others—induces a much larger ventilation of the lungs than any other—in fact, without inhalation of carbon dioxide too large a ventilation would be harmful; but that the prone pressure method has the great advantage that it can be applied immediately: a delay of even a few seconds, while apparatus is being brought and applied, may lose a life. Prone pressure is easier to teach and learn than any of the other methods; it can be continued longer without exhausting the operator; and

it aids the circulation by pushing blood toward the heart. Accordingly the Schafer prone pressure method was adopted, particularly by the American Red Cross, and the pulmotor and similar breathing machines (not then claiming the title of "resuscitators") which rely on alternately sucking and blowing were condemned. The resuscitation committee held that "inflation and deflation of a bag are deceptive because the bag, unlike the air passages of the body, offers no resistance till full. As soon as the inspiratory blast meets an obstacle in the air passages, it is automatically cut off and turned into expiration; and thus frequently no effective inspirations are performed." Thus the time within which the victim may be saved is lost while the apparatus merely clicks back and forth ineffectively. This has continued to be, and is now, the position of the American Red Cross (see its booklet on "Life Saving and Water Safety," page 189). It advocates (1) immediate manual prone pressure artificial respiration, and (2) simple inhalators as auxiliary aids; but it disapproves of suck and blow mechanical devices.

Between 1912 and the present time, four other committees have published the results of their investigations on methods of resuscitation: two in this country, one in 1918 and one in 1921, and one under the British Medical Research Council. Three of these committees have unanimously condemned suck and blow apparatus under whatever name; while only one —the above-mentioned Council on Physical Therapy —has accepted such devices. And thereby hangs the grotesque story which it is one of the objects of this article now to tell.

WHY DOCTORS PROMOTE "RESUSCITATORS"

The story is that of how and why it has come about that at the present time a large proportion of American physicians believe that the American Medical Association, through its Council on Physical Therapy, recommends "resuscitators"—a belief which is the principal basis for the extensive introduction of this apparatus. As a result, the sales agents of the E & J —as the most promoted of these devices is commonly called—find in every city and town of the United States one or several physicians of good standing in the community who are "members of the A.M.A." and read its journal and who on this basis confidently and conscientiously assure their fellow citizens that the purchase of a "resuscitator" for the hospital or the fire department is a public-spirited act.

Commercially, the sales campaign of the E & J is thus far ethical. But it does not stop at measures that are scientifically and commercially ethical. Three times at least that campaign has involved attempts to prevent the publication of scientific opinion or evidence adverse to the E & J "resuscitator." It happens that the first report adopted by the Council on Physical Therapy was never published. It was adverse to the E & J "resuscitator." I know, because I wrote it. I was at that time a member of the council and, as I had already tested the "resuscitator" on animals in my laboratory and had found it to be essentially a pulmotor, I was asked by my colleagues to draft the council's report. It was approved and adopted by the council. It was, in fact, on the point of publication in the *Journal* of the American Medical Association. But at that point unfortunately the E & J Company learned—or were informed—that the report was adverse. Thereupon they sent their lawyers to the then president (1934–35) of the American Medical Association and the report was suppressed by action of the trustees; and I resigned from the council. On my part this was a conscientious, but unwise act; for the agents of the E & J thereupon set themselves to winning the secretary of the Council on Physical Therapy to the support of their device. In contravention of that influence, I then invited the council to delegate a subcommittee of its members to join with me in testing the "resuscitator" on animals. Whether that invitation ever reached the full council, I do not know. But I do know that it reached the secretary, and that he made no reply. I know also that soon thereafter the agents of the E & J achieved their object: instead of their "resuscitator" being disapproved, it was added to the "list of devices accepted by the Council" (see *Jour. Am. Med. Asn.*, 112: 1945, May 13, 1939). Ever since that it has been supported in frequent published statements by the council as being at least as efficient a means of artificial respiration as the Schafer prone pressure method.

In this respect, the American Medical Association is in direct antagonism to the American Red Cross.

Twice in recent years the lawyers of the E & J Company have threatened suit against the publishers of the books in which I have reported my investigations in the field of resuscitation. One of these publishers ignored that threat with the scorn that it deserved. And nothing happened. The other publisher took the matter so seriously that he delayed the publication of the book ("Noxious Gases," by Henderson and Haggard), for six months and went to considerable expense for legal advice—as did I also—in defense of the right of an author to tell the truth.

In addition, it is of interest—to me at least—that in the latest advertisement of the E & J "resuscitator" one of those books is cited as supporting that device.

So matters have gone on until in their hunger for sales the agents of suck and blow apparatus have

nagged bureaus in the U. S. Army, Navy and Shipping Board to the point of asking the National Research Council for the appointment of a committee on the subject of "resuscitators." That committee met recently and made its report; and this report is about as adverse to "resuscitators" as is this article of mine.

So far so good. The various bureaus of the Federal Government will now be saved very considerable amounts of money, as well as the lives of many soldiers, sailors and marines. But that report is unfortunately "restricted" and will not decrease the mortality from asphyxia among the 130 million citizens of the United States, who will never hear of it.

THE CENTENARY OF THE CINCINNATI OBSERVATORY

By Dr. RAYMOND WALTERS

PRESIDENT OF THE UNIVERSITY OF CINCINNATI

THE commemoration in November, 1943, of the establishment in November, 1843, of the first astronomical observatory in America proved to be an occasion of national importance. Testimony to this importance was supplied in the felicitous letter of greeting received by the University of Cincinnati from the President of the United States:

> The founding of the Cincinnati Observatory a hundred years ago was an event of great significance in the march of science and culture in this country.
>
> The enormous advance in the science of astronomy since the venerable John Quincy Adams, former President, journeyed to Cincinnati to lay the cornerstone of the original building emphasizes the debt we owe to the Cincinnatians of a century ago whose vision and generosity made possible the establishment of the observatory.
>
> May I, in extending hearty greetings, express the hope that the work of the observatory will go steadily forward and that the sphere of its influence will ever widen in the decades ahead.

As reported in SCIENCE, the American Astronomical Society held its seventy-first annual meeting at Cincinnati from November 5 to 7, in conjunction with the university celebration; and digests of the papers then read have been published in this journal.

Scientific and human aspects of what Dr. Harlow Shapley, president of the society, termed "this romantically founded civic enterprise" were presented before a large audience of scientists and citizens in three centenary addresses delivered by Dr. Shapley; Mr. Robert L. Black, a member of the board of directors of the University of Cincinnati; and Dr. Raymond Walters, president of the university.

The historic background of Cincinnati a hundred years ago and the personality of Professor Ormsby MacKnight Mitchel, of Cincinnati College, founder of Cincinnati Observatory, were sketched by Mr. Black. In vivid, picturing words, he described the laying of the cornerstone of the Cincinnati Observatory on "that chilly November day when a national salute of 21 guns fired from Mount Ida, re-echoing from the low, heavy clouds, roused the 50,000 odd inhabitants of Cincinnati." The orator of the day was the illustrious John Quincy Adams, "small, neat, a quiet personage, still apple-cheeked in spite of his 76 years," who had endured rain, snow, cold and the rigors of a thousand-mile journey from Massachusetts to accept the invitation of Judge Jacob Burnet, one of the founders of Cincinnati College and president of the Cincinnati Astronomical Society.

Mr. Black depicted the scene: "Judge Burnet, tall, swarthy, austere," and Professor Mitchel, "a little terrier of a man, sharp-eyed, talkative, full of bounce," sat in the barouche with Mr. Adams as "the heavens opened, filling the streets with water." The long line of citizens paraded through the rain up to the top of Mount Ida, the location of the observatory-to-be. On a small stage there,

> Judge Burnet introduced the "old man eloquent" to the auditory of umbrellas. Mr. Adams read his address rapidly; before he was done the manuscript was so defaced by the rain as to be scarcely legible.
>
> Thereupon he laid the cornerstone, "invoking the blessing of Him, in whose presence we all stand, upon the building which is here to rise and upon all the uses to which it will be devoted.

Mr. Black then recounted the dramatic story of how it happened that a President of the United States, a judge and a professor thus met on a hilltop overlooking the Ohio River. The hero of the story was Ormsby MacKnight Mitchel, Kentucky-born son of Scotch-Irish folk, graduate of West Point, engineer, professor of mathematics and natural philosophy in Cincinnati College, and astronomer.

There was at that time no working telescope in America. Mitchel, lecturing on astronomy at Cincinnati, saw a vision. He "resolved to devote five years to the erection of a great astronomical observatory right here in the City of Cincinnati."

> He had not a penny in his pocket, no future prospect whatever except his $1,500 a year for teaching; he had little influence, political or social. "I will go to the people," he said . . . "I will plead the cause of science. . . . I am determined to show the autocrat of all the Rus-

sias that an obscure individual in this wilderness city in a republican country can raise here more money by voluntary gift in behalf of science than his majesty can raise in the same way throughout his whole dominions.''

And *that* he did.

How Mitchel organized the Cincinnati Astronomical Society, sold $6,500 worth of stock, went to London, then to Munich and there got an option on a $9,000 telescope, a 12-inch glass exceeded only by the Pulkova telescope; how he returned home and finally raised the balance due; how he obtained land for an observatory site and personally superintended the erection of the building; how he began publication of an astronomical journal, *The Sidereal Messenger*—all this was stirringly related in Mr. Black's admirable paper.

The address of President Walters outlined the academic background of Professor Mitchel's Cincinnati College which, founded in 1819, continues within the University of Cincinnati to-day. In the decade 1835–45, Cincinnati College had a remarkable flowering. Its faculty included President William H. McGuffey, author of the school books which influenced American life for several decades; Dr. Daniel Drake, who headed a medical department as brilliant as any in America of that day; Timothy Walker and John C. Wright, who made the law school famous for their *Western Law Journal* and for their classic texts in American law; and E. D. Mansfield, professor of history and journalist. Professor Mitchel served in this era as a teacher of mathematics, science and engineering. He began at Cincinnati College in 1836 one of the first collegiate courses of civil engineering in the United States.

Touching upon Professor Mitchel's astronomical dream and achievement, the speaker said:

> This little giant of Scotch Irish ancestry applied his powers of intellect, personality and character to fulfillment of St. Paul's dictum: ''This one thing I do.'' Despite discouragement, obstacles and disaster, he accomplished the thing he set out to do, which was the establishment in America of an astronomical observatory to rank with those of Europe.
>
> Then Professor Mitchel wrote, with quiet pride: ''The building of the Cincinnati Observatory has forever settled the great question as to what a free people will do for pure science.'' That utterance had the same noble tone of faith in the people embodied exactly twenty years later in the address of Lincoln at Gettysburg, November, 1863, in the midst of a war in which the college professor and astronomer of Cincinnati was to serve as a general in the Union Army.

The speaker went on to say that "such faith in the people was validated by the way in which the citizens of Cincinnati in Mitchel's own and later generations have carried on the enterprise he established."

As an outcome of a proposed merger of the old Cincinnati College, the newly created McMicken University and the Cincinnati Observatory, the University of Cincinnati was established in 1870. The Cincinnati Astronomical Society voted to merge with the university, and in 1878 the City of Cincinnati acted to maintain the observatory by taxation. In 1918 the city tax for the observatory was combined with that for the entire University of Cincinnati.

"The vital point is that the city tax continues to-day as the source of the observatory's income," Dr. Walters said. "Cincinnati is still fulfilling the faith of Ormsby MacKnight Mitchel as to what a free people will do for pure science."

"The Cincinnati Observatory has worked chiefly in sidereal astronomy and its long-continued studies of the proper motion of the stars have, in the words of Professor S. A. Mitchell, of the University of Virginia, 'made Cincinnati Observatory famous throughout the astronomical world.'"

We have confidence that, in the years to come, the high tradition established by Mitchel, carried on by Stone, Abbe, Porter, Yowell, and Elliott Smith will be advanced under Paul Herget, who is to return and become director of the observatory following termination of his present duties at the U. S. Naval Observatory.

To the advancement of the Cincinnati Observatory upon its fundamental ideals of scientific aspiration and popular support, I am privileged to pledge the cooperation of the University of Cincinnati and the people of Cincinnati.

Dr. Shapley began his address with felicitations to the University of Cincinnati upon the observatory centenary, and congratulations upon the appointment of Dr. Paul Herget as director to succeed the late Dr. Elliott Smith. Said Dr. Shapley:

> About a hundred years ago a famous English scientist pointed out to the citizens of Cincinnati what they should do to become the zero-point of the Western Hemisphere. Cincinnati would be to America what Greenwich is to England. Actually the plan didn't come off, perhaps because Cincinnati didn't want to be zero in anything. But at about the same time there was much interest in Cincinnati concerning a new European theory that the center of the universe is in the bright star cluster called the Pleiades.

Dr. Shapley then outlined the contributions made during the century since the founding of the Cincinnati Observatory to "the questions of centers,—the center of the earth, the center of the solar system, the center of the Milky Way." He raised the question: "Does the universe itself have a center?"

As to the theory of Maedler, well-known astronomer at Dorpat a century ago, that the bright star Alcyone in the Pleiades is the central body of the sidereal universe, Dr. Shapley explained that, while Maedler's

arguments were good, "subsequent research has shown that the center of the galaxy is in the Sagittarius, almost diametrically opposite to the place where it was put by Maedler. The distance is not a few hundred light years but more than 30,000 light years."

Dr. Shapley went on to say that the motion of the sun that was recognized a hundred years ago is not a motion of rotation around a galactic center, but is the sun's own private random motion with respect to neighboring stars. The rotation around the Milky Way center is some 200 miles a second and takes with it all the neighboring stars. The central nucleus of the Milky Way galaxy is for the most part invisible and immeasurable.

Dr. Shapley referred to various dynamic, photometric and spectroscopic ways in which astronomers now "explore the half-seen central nucleus of our galaxy. The researches on stars in the direction of the Pleiades are used to find the distance to the anti-center, that is, the distance to the rim of our wheel-shaped galaxy."

The speaker reported on the progress of Harvard researches on the galactic nucleus and the galactic anti-center, as well as on the diameter and thickness of the Milky Way. Illustrative slides were shown.

But the center of our galaxy is not the center of the universe. The identification of the spiral nebulae as external galaxies has completely changed the concept of a universal center. Our own galaxy is found to be a few hundred thousand light years from the center of the local supergalaxy, or group of galaxies.

But far beyond the bounds of our own local group of galaxies, we have mapped the positions of 500,000 other great stellar systems, and the questions before us now are: Is there a boundary to this overall system, the metagalaxy? Is there at the present time a great central dominating galaxy or group of galaxies? Is our galaxy or some other recognizable system at or near a center from which the other galaxies are receding in the expanding universe?

Dr. Shapley said that "nowhere do we find one king of all galaxies, enormous in mass and superlative in brightness. In fact, we seek in vain for a metagalactic center." He concluded that "there is no very good evidence that the universe is infinite or that it is finite."

There follow biographical sketches of the founder and first director of the Cincinnati Observatory and of its third director, Cleveland Abbe, under whom the observatory initiated a system of daily weather reports and storm predictions which led to the establishment of the United States Government Weather Bureau.

ORMSBY MacKNIGHT MITCHEL
1809–1862

THE energy and perseverance of Ormsby MacKnight Mitchel accomplished the task of building and equipping an observatory by popular contributions, a century ago in Cincinnati. Mitchel was born in 1809 in Kentucky of pioneer stock. When he was seven years of age, his father died and his mother moved to Lebanon, Ohio. He was taught at home, and then entered a school conducted by his brother. On account of limited finances, he started to support himself at the age of thirteen. An appointment to West Point gave him the desired opportunity to study, and after graduation, he taught mathematics for two years. Assigned to duty at St. Augustine, Florida, he soon grew tired of the tedium of garrison duty, resigned his commission and went to Cincinnati. First he tried the law, but without success; then he became professor of mathematics and natural philosophy at the old Cincinnati College.

In 1842, Mitchel delivered a course of lectures on astronomy that aroused great interest; at the last lecture he proposed a plan to build an observatory. He would solicit subscriptions of stock at $25.00 a share, and when 300 shares were subscribed, he would call a meeting of stockholders and organize a society. This he did; a constitution was adopted, and officers elected, including Judge Jacob Burnet as president and O. M. Mitchel as astronomer. Mitchel was sent to Europe to buy a telescope; finding nothing suitable in London or Paris, he went on to Munich, where he found a 12-inch glass, equal to Lamont's and inferior to the Pulkova telescope alone. Its price exceeded the funds in the treasury, but he ordered it and went home to raise the balance.

The building of an observatory was the next difficulty: Judge Nicholas Longworth donated four acres of ground on a hill east of the city, on condition that the building should be finished in two years; various citizens became stockholders, paying in cash or material or labor. The venerable John Quincy Adams was invited to lay the corner-stone—his interest in science was well known and, when President, he had recommended to Congress the founding of a national observatory. Though 77 years old, he accepted the invitation and traveled to Cincinnati by rail, by lake boat, by canal and finally by stage-coach. The city council met him at the city limits and escorted him to his hotel; the next day a parade, composed of military and civilian groups, conducted him to the hill, where he laid the corner-stone and delivered his address in spite of pouring rain. The city council named the hill Mt. Adams in his honor.

Mitchel promised to conduct the observatory for ten years without remuneration; when the college burned

down he was forced to earn his living by other means; yet his courage never failed, even though very little observing could be done. He made surveys for the Little Miami Railroad, now a part of the Pennsylvania system; later he made surveys for the Ohio and Mississippi Railroad, now called the Baltimore and Ohio Southwestern.

He tried lecturing on astronomy and was remarkably successful; his audiences were large and enthusiastic. In the spread of astronomical knowledge, in drawing the attention of thinking people to the beauties of astronomy and inspiring them with enthusiasm he paved the way for the founding of other observatories, the endowment of other institutions, and attracted to the subject young men of ability whose later work was creditable to American astronomy.

Another venture of Mitchel's was the publication of a popular journal on astronomy called the *Siderial Messenger;* two complete volumes were published, but it expired after a few numbers of the third volume appeared.

Mitchel worked on the problem of applying the electric current to record observations; his disk chronograph worked but was not as good as the cylindrical one developed by the Bonds.

In 1859 Mitchel was appointed director of Dudley Observatory and went to Albany in the following spring. But already the war drums were beating and on the outbreak of war, he resigned and was appointed a brigadier general in the U. S. Army. He conducted a successful campaign in the west, going as far south as Huntsville, Ala. He was transferred to the Carolinas and succumbed to yellow fever at Beaufort, S. C., on October 30, 1862. Professor Holden, first director of the Lick Observatory, speaks thus of his work:

> His direct service to practical observing astronomy is small, but his lectures, the conduct of the Cincinnati Observatory and the publication of the *Siderial Messenger,* together with his popular books, excited an intense and wide-spread public interest in the science and indirectly led to the founding of many observatories. He was early concerned in the matter of utilizing the electric current for longitude determinations, and his apparatus was only displaced because of the superior excellence of the chronograph devised by the Bonds. His work was done under immense disadvantages, in a new community, but the endowment of astronomical research in America owes a large debt to his energy and efforts.

CLEVELAND ABBE
1838–1916

CLEVELAND ABBE, the third director of the Cincinnati Observatory, was born in New York in 1838. He graduated from the College of the City of New York in 1857, studied under Brünnow at Ann Arbor for two years and worked with Gould at Cambridge during the period 1860–64. Then he spent two years as student and assistant under Otto Struve at Poulkova. Returning home, he served in the United States Naval Observatory for a short time and was called to Cincinnati in 1868 to rehabilitate the Cincinnati Observatory.

Abbe's interest in meteorology was early developed and continued all his life. He said:

> The popular articles in the New York papers by Merriam, Espy, Joseph Henry and others—notably Redfield and Loomis—had by 1857 convinced me that man should and must overcome our ignorance of destructive winds and rains.

The opportunity to investigate weather conditions came to him in Cincinnati. Thus he described it:

> In my inaugural Cincinnati address of May 1, 1868, I stated that with a proper system of weather reports the public need of forecasts could be met and that astronomy could also be benefited.
>
> The suggestion was taken up by Mr. John A Gano, president of the local chamber of commerce: a committee met me, approved my plans, and promised the expenses of a first trial.

The Western Union Telegraph Company cooperated with Abbe and the Chamber of Commerce: observers in other places made the meteorological observations at a specified time and telegraphed them to Cincinnati. The Chamber of Commerce paid the expenses for the first three months; Abbe analyzed the data and made the predictions. He made a map on which were located the places sending the data, the temperature, direction of wind and weather. These were manifolded and sent to the various subscribers; and the predictions were also published in the daily papers. On September 1, 1869, the first *Cincinnati Weather Bulletin* appeared; at the end of three months, the Western Union assumed charge of the *Bulletins* and Abbe continued to make the predictions. He was nicknamed "Old Probs" by the employees of the Western Union, a name that clung to him, but has sometimes been applied to other weather men.

Abbe resigned in 1870 to accept a position as assistant in the office of the Chief Signal Officer. By a law, passed by Congress in 1870, the creation of a weather service was authorized and placed under the direction of the Signal Service of the Army.

Abbe organized the forecast work and began preparing the tri-daily synopses and probabilities of the weather. He also inaugurated the *Monthly Weather Review* and contributed a great many articles to this publication; he took a leading part in all the activities of the national weather service. In virtue of his having started a weather service here in Cincinnati and having published his "probabilities," we consider

his work here as a forerunner of the present national Weather Bureau.

In 1912, the Symons Memorial Gold Medal of the Royal Meteorological Society was bestowed upon him, and the president, Dr. H. N. Dickson, paid him this tribute: He "has contributed to instrumental, statistical and thermodynamical meteorology and forecasting" and "has, moreover, played throughout the part, not only of an active contributor, but also of a leader who drew others into the battle and pointed out the paths along which attacks might be successful."

It is highly appropriate that a tablet, with this inscription, is placed in the Abbe Meteorological Observatory in Cincinnati:

U. S. Department of Commerce
Weather Bureau
ABBE METEOROLOGICAL
OBSERVATORY
Established April 1, 1915
Named in Honor of
1838 CLEVELAND ABBE 1916
First official U. S. Weather Forecaster

EVERETT I. YOWELL

OBSERVATORY OF THE
UNIVERSITY OF CINCINNATI

OBITUARY

DEATHS AND MEMORIALS

DR. EPHRAIM PORTER FELT, entomologist, director of the Bartlett Tree Research Laboratories, from 1898 to 1928 New York State entomologist, died on December 14. He was seventy-five years old.

DR. JOHN HARVEY KELLOGG, surgeon, director of the Battle Creek Sanitarium and founder of the W. K. Kellogg Company, died on December 14 at the age of ninety-one years.

PROFESSOR CHARLES HENRY HAWES, anthropologist, a former associate director of the Museum of Fine Arts at Boston, died on December 13. He was seventy-six years old.

THE hundredth anniversary of the birth of Robert Koch occurred on December 11. *The New York Times* writes: "Forty years ago the death rate from that once dreaded disease was 200 per 100,000; today it is 40 per 100,000—a decline of 80 per cent. No longer is tuberculosis the leading cause of death; it now ranks eighth on the list of deadly diseases. This improvement can be explained only in terms of the remarkable discovery made by Robert Koch that tuberculosis is caused by a bacillus—a discovery that made it possible for physicians to consider tuberculosis as a scientific problem."

SCIENTIFIC EVENTS

THE POST-WAR FORESTRY POLICY OF GREAT BRITAIN

A POST-WAR forestry program, which aims at increasing the forest area of Great Britain to 5,000,000 acres in the course of five decades, is recommended in a report to the Government by the Forestry Commissioners which was recently presented to Parliament by the Chancellor of the Exchequer. It is described by the Parliamentary correspondent of *The Times*, London, who says that this White Paper on "Post-War Forest Policy" is an important contribution to wider schemes of planning, and aims at reconciling claims of amenity with economic utilization in the use of more land for the growing of trees. He continues:

For the second time in a generation British woodlands are being subjected to intensive exploitation to meet war needs. The total area of woodland felled or devastated during and immediately after the last war was about 450,000 acres. Depletion will certainly go much farther in this war than in the last, and the scale of reconstruction will have to be correspondingly larger. The forestry position is already much worse than it was in 1918, and a reorientation of thought is necessary.

We have had a national forest policy only since 1919, when the Forestry Commission was established. In spite of checks owing to "lack of stability of finance" a national forest estate aggregating 714,000 acres of plantable land has been acquired; and of this 434,000 acres were under woodlands by the end of 1939. The new State plantations are making a contribution, but the great bulk of home-produced timber now being felled is coming from private woodlands. To reduce imports and save shipping millions of tons annually of timber are being provided from home sources.

The report suggests that the nation should now make up its mind to devote 5,000,000 acres to afforestation. That area is required for national safety and will also provide a reasonable insurance against future stringency in world supplies. (It is estimated that the area proposed would ultimately produce about 35 per cent. of the normal consumption of timber.)

These 5,000,000 acres should be not merely planted with trees, but also systematically managed and developed. It is estimated that 5,000,000 acres of effective forest can be secured by the afforestation of 3,000,000 acres of bare ground and by selecting from existing woodlands 2,000,000 acres of those which are better suited for forestry than

for any other national purpose. It is proposed that the 2,000,000 acres of existing woodlands, so far as they are privately owned, should be either "dedicated" by their owners to forestry or acquired by the State.

The planning of the further 3,000,000 acres would mean the transfer to timber growing of this area from the 16,000,000 acres of uncultivated land at present classified as "rough grazings." The land for afforestation would be drawn only gradually from its present use and the loss to food production would be relatively small. The maximum area of bare land to be planted in the first post-war decade would be 500,000 acres.

It is proposed that the attainment of the 5,000,000 acres of effective forest should be spread over fifty years, though the rate of progress be subject to review and amendment.

The policy is also considered from the point of view of employment. It is estimated that the employment that would be provided by 5,000,000 acres of forest in full working order would be 50,000 men in the forests working full time and 200,000 in forest industries, a total of 250,000. These figures would be attained very gradually.

There are at present three national forest parks. The report suggests that without special effort one new park of this kind might be established every year for the next ten years at a capital outlay not exceeding £50,000; and that for the expenditure of £150,000 the total number of national forest parks could be increased to twenty by the end of the first post-war decade. There are twelve youth hostels in the existing national forest parks, and the report foreshadows an extension of the provision for recreational facilities in the new parks, with semi-permanent camps. It suggests that, if in view of the large schemes here outlined, Parliament should desire to place forestry under the direct control of a Minister, the Minister chosen should be the Lord President of the Council, and that he should be assisted by a committee, including the Secretary of State for Scotland, the Minister of Agriculture and the chairman of the Forestry Commission.

The chairman of the Forestry Commission is Sir Roy Robinson, and its members include representatives of all political parties.

THE RESEARCH COUNCIL ON PROBLEMS OF ALCOHOL

A GENERAL plan of reorganization of the Research Council on Problems of Alcohol was approved by the council on November 23. The provisions of the plan are as follows:

(1) The officers will consist of a president, six vice-presidents, a secretary and a treasurer. The president, secretary and treasurer shall be *ex-officio* members of the Board of Directors.

(2) The Board of Directors will consist of 40 members, 28 to be chosen on a regional basis, and 12 to be members at large. It will be made up of an increasing number of businessmen. The board will meet annually—if practicable, at the time of the council's annual business meeting and the annual meeting of the scientific committee.

(3) An executive committee of seven members of the board will meet quarterly, with additional meetings as required.

(4) The new board and its executive committee will give special attention to the business and financial affairs of the council.

(5) An executive committee of seven members of the scientific committee will be appointed to give closer attention to research on the treatment of alcoholism.

(6) A new committee on alcoholism will be created. It will be composed of doctors treating alcoholics, liquor control administrators and representatives of the church, the distilling industry and the alcoholics anonymous group, together with others having some special interest in the problem of alcoholism. Sub-committees will be appointed to deal with the following subjects: The dissemination of the results of research, the treatment of alcoholism, the development of hospital facilities, state and local organizations, and the legal aspects of alcoholism.

REORGANIZATION OF THE PUBLIC HEALTH SERVICE

As reported in the *Journal* of the American Medical Association, Dr. Thomas Parran, surgeon general of the U. S. Public Health Service, has announced the appointment of heads of the five new bureaus and divisions set up through the reorganization of the U. S. Public Health Service by Congress on November 11.

The reorganization was authorized in the enactment of a bill (S. 400). Dr. Lewis R. Thompson, medical director serving in the surgeon general's office, has been named assistant surgeon general in charge of the new Bureau of States Services. Dr. Ralph C. Williams, formerly district director with headquarters in New York, has been named assistant surgeon general in charge of the new Bureau of Medical Services. Dr. Rolla E. Dyer, director of the National Institute of Health, Bethesda, Md., will in addition serve as assistant surgeon general in charge of the new Bureau of Scientific Research. John K. Hoskins, senior sanitary engineer, under the new set-up will become chief of the division of sanitary engineering and William T. Wright, Jr., D.D.S., chief of dental work in the Marine Hospital Division of the Public Health Service, will become chief of the division of dentistry. All five will hold rank comparable to an army brigadier general. They have been in a grade comparable to a full colonel in the army. Mr. Hoskins is said to be the only non-doctor or dentist to hold a rank in the Public Health Service comparable to brigadier general. S. 400 provides that the surgeon general of the Public Health Service, under the supervision and direction of the Federal Security Administrator, is authorized and directed to assign to the Office of the

Surgeon General, to the National Institute of Health and to the Bureau of Medical Services and the Bureau of States Services, the functions of the Public Health Service and to establish within the office of the surgeon general and the other groups named such divisions, sections and other units as may be required to perform their functions.

NATIONAL RESEARCH COUNCIL GRANTS FOR RESEARCH IN ENDOCRINOLOGY

IT is announced that requests to the National Research Council Committee for Research in Endocrinology for aid during the fiscal period from July 1, 1944, to June 30, 1945, will be received until February 28. Application blanks may be obtained by addressing the Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington, D. C. In addition to a statement of the problem and research plan or program, the committee desires information regarding the proposed method of attack, the institutional support of the investigation and the uses to be made of the sum requested. No part of any grant may be used by the recipient institution for administrative expenses. Applications for aid of endocrine research on problems of sex in the narrower sense can not be given favorable consideration, but the committee will consider support of studies on the effects of sex hormones on non-sexual functions—*e.g.*, on metabolism.

ANDREAS VESALIUS

THE Historical Library of the Yale University School of Medicine has arranged for the publication of a life of Andreas Vesalius, the great military surgeon and one of the most important figures in medicine of all time. During the winter of 1544, Vesalius served with the armies of Charles V in the Marne Valley, at Soissons, Château Thierry and the Argonne. His biographer, the late Dr. Harvey Cushing (Yale 1891), had struggled in the same terrain in the last war, and he dedicated the energies of the last years of his life to the portrayal of the life and work of Vesalius.

Plans had been laid to celebrate the four hundredth anniversary of the birth of Vesalius in 1914, but the last war prevented the observance, and the Louvain Library, which contained many of the most important relics, was destroyed. The Historical Library, where Dr. Cushing's great Vesalian collection is housed, not only celebrated, as it did on October 30, the 400th anniversary of Vesalius' book "On the Structure of the Human Body," but also published Dr. Cushing's "Bio-bibliography of Andreas Vesalius" (issued by Schuman's in New York). In acknowledging assistance which has come from Dr. W. W. Francis, of the Osler Library in Montreal, of Dr. Edward Clark Streeter, curator of Museum Collections of the Yale Medical Library, and of Dr. Arturo Castiglioni, research associate in the history of medicine and formerly professor of medical history at the University of Padua, Dr. Fulton in his preface comments:

> Because of his knowledge of anatomy Vesalius undoubtedly found himself better equipped to deal with war injuries than many of his contemporaries, excepting of course Ambroise Paré who, like many surgeons of 1943, had learned anatomy the hard way—in the field of battle. For these, and many other reasons, we have persevered in bringing out the Vesalius bio-bibliography in 1943, at a time when physicians on every battle front will undoubtedly welcome a reminder of the man who at the early age of twenty-eight years first adequately portrayed the fabric of the human body. When the lights burn low and tradition falters, we must carry the torch of remembrance until it can flame again and brighten the paths of learning and free thought for those who now "sit in darkness and in the shadow of death."

SCIENTIFIC NOTES AND NEWS

THE Association of Military Surgeons of the United States on October 22 presented its Gorgas Award to Hugh S. Cumming, surgeon general, U. S. Public Health Service, retired, and at present director of the Pan American Sanitary Bureau. The award was founded in 1942 by John Wyeth and Company of Philadelphia and consists of a medal and scroll and $500. It is given each year to a member of the association who has made "notable contribution to medical science of value to the military service."

THE Massachusetts Horticultural Society has awarded the George Robert White Medal to Richardson Wright, of New York City, editor of *House and Garden*.

A DINNER in honor of Dr. Carl J. Wiggers on the completion of twenty-five years as professor and head of the department of physiology at the School of Medicine of Western Reserve University, was given on November 18 by his associates and students. Dr. Torald Sollmann, dean of the medical school, presided.

HONORARY memberships in the American Society of Mechanical Engineers given to "persons of acknowledged professional eminence elected by unanimous vote of the council" were conferred at the sixty-fourth annual meeting in New York City on Francis Blossom, of New York, fellow of the society and a partner of Sanderson and Porter, Engineers; on

Ralph Budd, of Chicago, president of the Chicago, Burlington and Quincy Railroad; on Edward N. Trump, of Syracuse, N. Y., fellow and past-president of the society, a senior member of E. N. and C. C. Trump, mechanical and chemical engineers; and on Roydon V. Wright, of New York, a fellow and past-president of the society, vice-president and secretary of the Simmons-Boardman Publishing Corporation, managing editor of *Railway Age* and editor of the *Railway Mechanical Engineer*.

THE *Journal* of the American Medical Association reports that at the meeting on November 6 of the American Academy of Pediatrics in Chicago the 1943 recipients of the Mead Johnson awards were announced. The first prize of $500 was given to Dr. Hattie E. Alexander, New York, for her work on "The Treatment of the *H. influenzae* Infections," and the second prize of $300 to Dr. Philip Levine, Newark, N. J., for his work on "Erythroblastosis Faetalis and the Rh Factor." At the meeting Dr. Joseph S. Wall, Washington, D. C., was named as president-elect of the academy and Dr. Franklin P. Gengenbach, Denver, was installed as president. Dr. Clifford G. Grulee, Evanston, Ill., was reelected secretary-treasurer.

DR. DUNCAN A. MACINNES, physical chemist, a member of the Rockefeller Institute for Medical Research, was elected president of the New York Academy of Sciences at the one hundred and twenty-sixth annual meeting on December 15.

DR. MAX NEUBURGER, formerly professor of the history of medicine at the University of Vienna and since 1939 associated with the Wellcome Historical Medical Museum in London, observed his seventy-fifth birthday on December 8.

LIEUTENANT-COLONEL EDGAR PAM, consulting engineer to and deputy delegate director of the Mond Nickel Company, Ltd., has been elected president of the Institution of Mining and Metallurgy for the coming session.

DR. FOREST F. HILL has been appointed head of the department of agricultural economics of Cornell University, and Cedric H. Guise has been made head of the department of forestry to succeed Professor A. B. Recknagel, who recently retired. Dr. Hill, who has been professor of land economics and who is a former governor of the Farm Credit Administration, succeeds Dr. W. I. Myers, now dean of the College of Agriculture. Dr. Kenneth Post, associate professor of floriculture, has been made acting head of the department of floriculture.

DR. THOMAS J. HEADLEE, since 1912 head of the department of entomology of Rutgers University and of the State Agricultural Experiment Station, will retire on January 1.

DR. CHARLES ANDERSON ALDRICH, professor of pediatrics at the Medical School of Northwestern University and physician-in-chief to the Children's Memorial Hospital, will organize and direct a long-term research program in preventive medicine in childhood at the Graduate School of the University of Minnesota. The project will be financed by the Mayo Clinic and will be carried out in cooperation with Dr. Henry F. Helmholz, Rochester, Minn., who is in charge of the department of pediatrics at the clinic.

DR. M. W. DEHN, of the Illinois Institute of Technology, has become professor of mathematics at St. John's College, Annapolis.

DR. NATHAN JACOBSON, of the University of North Carolina, has been appointed to an associate professorship of mathematics at the Johns Hopkins University.

DR. GEORGE A. EMERSON, associate professor of pharmacology at the Medical School of the West Virginia University, Morgantown, has become professor of pharmacology at the Medical Branch of the University of Texas. He will continue his work on the effects of anesthetic agents and the effects of drugs in anoxia. Dr. Charles M. Pomerat, professor of biology at the University of Alabama, has been appointed professor of anatomy; R. W. Strandtmann, of the Ohio State University, has become assistant professor of entomology in the department of preventive medicine and public health; Dr. Ardell N. Taylor, of the University of Texas, has been made instructor in physiology and Dr. Jewell G. Hamrick, of the Medical College of Virginia, instructor in pathology.

DR. G. C. WALLIS, associate professor of dairy husbandry, South Dakota State College, known for his work on the vitamin D requirements of dairy cows, has been appointed assistant technical director of the special products department of Standard Brands.

DR. H. E. MYERS, professor of soils at Kansas State College, has been granted leave of absence for two years to serve as agricultural adviser to the Department of State. Since about November 1 Dr. Myers has been working at the American Legation at Cairo, Egypt, and plans to visit parts of North Africa and the Near East. Hugh G. Myers, of the Division of Dry Land Agriculture at Garden City, has accepted a temporary appointment as associate professor of soils during Dr. Myers' absence.

DR. M. G. SEELIG, director of pathology in the Bar-

nard Free Skin and Cancer Hospital, St. Louis, has been appointed a member of the State Cancer Commission by Governor Forrest C. Donnell.

PROFESSOR GEORGE B. CRESSEY, who has leave of absence from Syracuse University and who has been appointed visiting professor in China under the program of Cultural Relations of the Department of State, arrived in Chungking on November 22. While *en route* he spent a month in India visiting various universities. Professor Cressey has been appointed by the Secretary of State, Mr. Cordell Hull, and by the National Academy of Sciences to assist in developing closer relations between Chinese and American scholarly organizations.

PROFESSOR PIERRE DANSEREAU, of the department of biogeography of the University of Montreal, was a guest of the department of zoology and physiology of the University of Illinois at Urbana from October 15 to November 13. His chief purpose was to confer with Professor V. E. Shelford on problems of ecological research and teaching. Incidentally, he gave a number of lectures at the university on the ecology of the Northwest and the Quebec region.

DR. FRED C. KOCH, director of biochemical research with Armour and Company, Frank P. Hixon distinguished professor of biochemistry emeritus of the University of Chicago, recently spent two weeks at the University of California at Berkeley making a study of the work being carried out by Dr. Herbert M. Evans and his staff in the Institute of Experimental Biology.

FRED CORRY BISHOPP, assistant chief of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, delivered on December 16 before the Washington Academy of Sciences an illustrated address entitled "Insects and the War."

THE William E. Lower lecture of the Academy of Medicine of Cleveland and the Cuyahoga County Medical Society was given on November 19 by Dr. Irvine Page, director of the Lilly Clinic of the Indianapolis City Hospital. His subject was "The Nature of Hypertension."

DR. EDGAR POTH, professor of surgery at the Medical Branch, University of Texas, Galveston, delivered from December 10 to 30 a series of lectures at the Medical School in San Francisco of Stanford University.

PROFESSOR L. C. DUNN, of Columbia University, gave on November 30 an address at a meeting of the Society of Sigma Xi at the University of Connecticut on "Soviet Research in the Biological Sciences." He also exhibited a Soviet medical film entitled "Experiments in the Revival of Organisms."

DR. HERBERT M. EVANS, professor of anatomy and director of the Institute of Experimental Biology of the University of California, was the guest speaker on December 6 before the staff and students of the Medical Branch of the University of Texas at Galveston. He gave an account of the work of the institute in the isolation and purifying of the anterior pituitary hormones. At a luncheon in his honor he led a discussion on source materials concerning early American experiments in socialized medicine.

DR. HERBERT C. CLARK, director of the Gorgas Memorial Laboratory, Panama, lectured in Denver on November 29 and 30, under the auspices of the John and Mary R. Markle Foundation and of the National Research Council. He spoke on "Malaria: Precautions in the Unsanitated Areas of the Tropical Lowlands" and on "Distribution and Complication of Amebic Lesions."

AN honor award to the master quartz blowers of the United States was presented at the Exposition of Chemical Industries on December 6 by Dr. Hugh S. Taylor, professor of chemistry at Princeton University. The award was accepted by George Kennell, Hanovia Chemical and Manufacturing Company, Newark.

THE two hundred and fifty-ninth meeting of the American Physical Society, the 1943 annual meeting, will be held at Columbia University on Friday and Saturday, January 14 and 15. The American Association of Physics Teachers holds meetings at the same time and the Physical Society will take part in its symposium. The Electron Microscope Society of America will hold its first meeting in conjunction with the Physical Society. According to the *Bulletin* of the society "the distinction of their programs is such that the officers of the Physical Society have felt justified in arranging for no papers, beyond the retiring presidential address and the contributed ten-minute papers."

DEVELOPMENT of an aboretum devoted primarily to the trees native to Pennsylvania, at the Bowmans Hill State Wildflower Preserve, has been planned for this year, which is the three hundredth anniversary of the birth of William Penn. This preserve is at Washington Crossing Park and was established nine years ago. The arboretum will comprise twelve acres and will be designated "Penn's Woods" in honor of William Penn, founder of Pennsylvania.

IN a recent raid the Hull Municipal Museum was completely gutted by fire and all the material destroyed. In addition all records were lost. The material destroyed includes the Norman collection of diatoms; the Dobree collection of European noctuae;

the Russell, Barker and Boult collections of butterflies and moths; the Schlesch and other collections of marine, land and fresh-water mollusca; the Swailes collection of eggs, and the Boynton, Pease and Fortune collection of British birds.

FIRMS in the Swedish rubber industry together with the Swedish Cooperative Union, have formed a company to provide Professor Svedberg, head of the Physical Chemical Institute at Uppsala, with better facilities for working out his process for the manufacture of synthetic rubber using calcium carbide as the main raw material. The initial capital of the company is 175,000 kr., but this is capable of being increased to 525,000 kr. The site for an experimental works and for a new laboratory has already been purchased near Uppsala.

The Lancet states that as a tribute to the courage and endurance of the people of Malta, the Nuffield Foundation has, with the approval of Lord Nuffield, offered to provide grants for the training in Great Britain of six Maltese physicians chosen by the government of Malta for appointments in the public service of the island. The grants will be tenable for a period not exceeding two years. The men or women who are chosen will receive a grant of £400 per annum if unmarried, and £600 if married and a further allowance in traveling expenses. The recipients will be required to give an undertaking to return to the island at the end of their training to take up the appointment for which they have been selected. The institutions in which they will receive their training will be chosen by the trustees of the foundation in consultation with the Colonial Office.

DISCUSSION

CONFUSION OVER GLACIAL LAKE SPOKANE

No small part of exploratory science has been the work of amateurs. In general they have received generous treatment from professional researchers, though no doubt they are annoying at times. The amateur can sometimes function, figuratively speaking, as a navigator of a trial balloon. Having no reputation at stake he may "take a flyer" into a field which looks unpromising to a professional. Twenty-one years ago SCIENCE (September 22, 1922) published a report of such an adventure. The reporter who is now furnishing this memorandum had encountered difficulties in getting information needed for making the physiographic features of the Spokane region have any meaning to his high-school students in general science. After fruitless inquiries of local and some other geologists and eighteen months of puzzling in the local field, two trial papers were written—the first for the students, the second read before the Associated Engineers of Spokane. The latter was sent to Chicago University Geology Department and to the U. S. Geological Survey. That summer, 1922, both sent representatives to investigate. One could find nothing with which to agree. The other seemed to be in substantial agreement. (The Chicago representative's visit was the beginning of a series of eight field seasons spent in this locality, and a very interesting controversy.)

This interest shown by real geologists gave the amateur courage to send his conclusions to SCIENCE for publication. They dealt almost exclusively with evidence of glaciation about Spokane. For the present memorandum the important matter among the thirteen conclusions presented was the evidence of a glacial lake in the valley of the Spokane River, formed by an ice dam made by a lobe of the Cordilleran ice-sheet which approached Spokane from the north and extended almost due south on its eastern margin, at least to a short distance south of Spangle, twenty miles south of the city. This eastern margin was marked by a moraine consisting mainly of large ice-dribbled boulders in the valley floor and waterlaid gravel with a mingling of enormous granitic boulders at Pantops, the southeastern corner of the city. No undisputed glacial deposits are found in the valley for some distance eastward. The terminal moraine of the Rathdrum glacial lobe appears in Idaho. This lake was given the name of Lake Spokane. It was believed to receive all waters from Eastern British Columbia, western Montana and northern Idaho as far south as the St. Joe River at the southernmost extremity of Lake Coeur d'Alene. Thus it was conceived of, not as a mere melt-water marginal lake, but as a major interruption of drainage, impounding the waters flowing westward from the Continental Divide and diverting them over a low range of mountains through its outlets at Mica, twelve miles southeast of Spokane, by two channels which, when they ceased to function as a water course for a vast drainage, left a crest of 2,478 feet (bench mark at Mica). The lake level may then be assumed as about 2,500 feet A.T. at its lowest level, giving a depth of about 500 feet in the immediate vicinity of Spokane. In other words, the 2,500 feet contour line on topographic maps of Washington and northern Idaho would about mark

the shoreline of this lake. This enlarged Lake Coeur d'Alene greatly.

Prior to the recognition of Lake Spokane erratic boulders as far up the Coeur d'Alene River as Kellogg, Idaho, were suspected by Hershey to have been carried in by floating ice. Attempts to place the lake border to the northeast and into Montana is only futile guessing, for a well-marked characteristic of the whole area of the lake is the presence, everywhere almost, of boulders and boulder till carried in on stranded icebergs, indicating that the glaciers and lake joined in that direction. In absence of such obstructing ice Lake Spokane would have overflowed the low divide just north of Sandpoint, Idaho, into the valley of the Kootenay River and would never have attained a level much over 2,700 feet A.T.

The Mica channels lead to Latah (Hangman) Creek Valley, which was also blocked by the glacier near Spangle. A low divide at the head of North Pine Creek permitted an overflow into North Pine Creek Valley, the final high level of this divide being just under 2,450 feet. (For recorded evidence of these levels see U. S. G. S. topographic maps, Spokane, and Oakesdale Quadrangles.) To the impounded water in the valley of Latah Creek, Dr. Bretz gave the name, Lake Latah.

In SCIENCE of September 10, 1943, Professor William H. Hobbs announces his discovery in the past summer of a Pleistocene lake in Spokane Valley to which he gives the name of Lake Spokane. Between the time of writing the article and its publication (September 10, 1943), he discovered in the *Pan American Geologist,* date 1924, a description of Lake Spokane, apparently having failed to find the earlier article in SCIENCE of 1922. Immediately on finding the earlier observations and naming of the lake, he sent compliments on "keenness of observation" but insisted the lakes were not the same because the one he had described was on a much larger scale. This larger scale lake in the same valley is determined by the finding of a delta of a creek in the basin of Lake Latah indicating a water level of 2,508 feet or 30 feet higher than the present level of the bottom of the Mica channel, and 58 feet higher than the highest present level of the North Pine Creek outlet. Neither of these channels have carried a stream of water since the melting of the ice barrier at Spokane. Hence they are, probably, near their Ice Age levels. The volume of water carried by these channels was of course the same for each pair, and considering the area drained it is fair to assume that was considerable. The comparative erosion rate can not well be estimated. It may be assumed also that each channel was deepened somewhat. In width the channels do not differ much. It would require only a depth of water of thirty feet flowing over the summit at Mica to invalidate all claim to a larger lake. A temporary ice dam in the North Pine Creek channel is not impossible but is probable. There was an abundance of floating ice. Such an obstruction in the North Pine Creek outlet of fifty-eight feet would raise the lake level enough to permit a delta of the height Dr. Hobbs found.

This North Pine Creek Valley is the eastern-most of the many "scabland channels." As there is in this channel no hint of glaciation it offers a good check on the possible effects of torrential waters which seem to be a stumbling block in Dr. Hobbs's acceptance of Dr. Bretz's explanation of the scablands. It is a miniature Grande Coulee conveniently located where the highway between Spokane, Pullman and Moscow parallels North Pine Creek, two miles north of Rosalia.

It will no doubt be interesting to have a glacialist of Dr. Hobbs' wide experience enter this field of central Washington with its still smouldering problems of the formation of the "scablands," but is unfortunate in its timing for few geologists can spare time from the war effort to reconsider these problems of great controversy of the twenties.

What seems a ground for agreement in this case is the probability that Dr. Hobbs, in his hasty survey of the area, has found evidences of an earlier and more extensive glaciation than that of the "Spokane ice" (evidence of which has not been entirely overlooked hitherto) which could be capable of producing the "anticyclone" effect which he has found in his studies in various parts of the world to be responsible for the formation of loess wherever it is found. In this case the loess deposits are the wheatlands of the Big Bend, the Pendleton and the Palouse regions. The recognition of this as the earlier glaciation of the region and of Palouse soil as loess would be in accord with our observations that the formation of the Palouse soil preceded the Spokane glaciation, as shown by the fact that there is no mantle of this soil in the North Pine Creek Valley, from which it was swept by the waters from Lake Spokane. Dr. Hobbs' westward extension of Lake Spokane as Lake Leverett seems to fit nicely as the immediate water source for the heads of Dr. Bretz's scabland channels, through which the water, 500 feet deep in Lake Spokane, was funnelled when the ice dam burst, and from Lake Missoula, 1,200 feet deep at Missoula, came, perhaps in successive floods, as the recurring periods of advance and "recession" of the glacier occupying the Purcell Trench operated the valvelike outlet at the head of Lake Pend Oreille of the waters covering a great part of western Montana.

THOMAS LARGE

SPOKANE, WASH.

EARLY HYDROGRAPHIC WORK ON AN AMERICAN LAKE

FOR many years there has been hanging in the building of the Skaneateles Library Association, Skaneateles, N. Y., a framed manuscript chart of Skaneateles Lake. It is poorly drafted to a scale of a little more than an inch to a mile, on two pieces of paper that had lain folded for years before being mounted, and has probably rarely received more than a casual glance. Recently, through the kindness of the association, particularly its librarian, Miss Alice E. Washburn, the writer was able to examine this chart more closely.

The chart was drawn up in 1824 and in 1827 by a Captain Benjamin Lee,[1] primarily on the basis of a series of soundings made by him with "deep-sea leads" made for the purpose. Apparently he made no survey of the shores or outline of the lake, for his delineation of its configuration, while vaguely correct, evidently was strongly influenced by the presumed meaning of the Indian word "Skaneateles"—"The Beautiful Squaw"[2]—and his indicated widths of the lake in places near the lakehead are twice the actual figures. The soundings, however, are quite accurate when compared with the bathymetric map of the lake prepared by the College of Engineering, Cornell University, and published by Birge and Juday in 1914.[3] Lee's chart indicates a maximum depth of 275 feet off "Nine Mile Point" (now Carpenter's Point), whereas the maximum depth, at approximately the same place, is 287 feet, according to Plate III of the paper cited (but given as 297 feet in the text, p. 537).

Curiously, through two compensating errors, Lee's estimate, contained in a manuscript note on the chart, of the volume of water in the lake is very near the figure arrived at by Birge and Juday ninety years later on the basis of far more complete and accurate data. Lee estimated the area at 20 square miles and the average depth at 100 feet, with a volume of 1,546,240,000 long tons (55,664,640,000 cubic feet). Actually the lake has an area of 13.9 square miles and a mean depth of nearly 143 feet, with a volume of 55,151,000,000 cubic feet (Birge and Juday, p. 537).[3]

Most significantly, however, Lee took bottom samples with his "deep-sea leads" and indicated on his chart, in proper nautical fashion, the character of the bottom at a number of sounding stations. The accuracy of this aspect of the chart can not be completely verified at present, for we know no more about the bottom sediments of the Finger Lakes now than in Lee's day, so far as published data are concerned. In general, except for local near-shore or shore-line deposits of sand and gravel, they are assumed to be composed of silts and muds, and from the writer's very limited investigations this generalization holds at least for the heads of Cayuga and Skaneateles lakes.[4] On Lee's chart, however, the bottom of the center of the lake at three stations between Carpenter's Point and a point a short distance south of Mandana is noted as "clean white sand." North and south of these points the bottom is indicated as muddy. This would seem to be worth checking, for even if it proved to be neither clean nor white, a sand bottom in the middle of such a lake, virtually a gigantic settling basin, is unexpected.

Lee's manuscript chart, in spite of its imperfections, is not only interesting historically, but significant scientifically because it contains data bearing on a problem that unfortunately has not yet been studied in the case of any of the Finger Lakes, namely, the nature, distribution and origin of the bottom deposits —a problem whose solution should shed much light on the late Pleistocene and Recent geological history of central New York.

JOHN W. WELLS
THE OHIO STATE UNIVERSITY

[1] This may have been the Benjamin Lee mentioned in the "National Cyclopedia of American Biography," who, after having been a minor officer in the British Navy during Revolutionary times, came to this country and entered the merchant marine as a captain. He lived in Cambridge, Mass. The chart very likely resulted from observations (for amusement?) made while visiting the pleasant, cultured village of Skaneateles.

[2] The proper rendering of Skaneateles is "long lake" (see H. W. Thompson, 1940, "Body, Boots and Britches," Philadelphia, p. 461).

[3] E. A. Birge and C. Juday, *U. S. Bur. Fisheries Bull.*, 32: 525–609, pls. 111–115, 1914.

[4] About 27 years ago Professor G. D. Harris made several dredgings of the bottom at moderate depths near the head of Cayuga Lake in connection with the late Carlotta Maury's studies of the molluscan fauna of central New York. Fine gray mud was reported (*Nautilus*, Vol. 30, p. 32).

PRE-TENNYSONIAN THOUGHTS ON AIR TRANSPORTATION

IN the issue of SCIENCE for November 12, 1943, on page 431, Mr. M. F. Ashley Montagu quoted certain stanzas from "Locksley Hall," in which Tennyson anticipated aviation in its commercial and military aspects. It is thought that the following two extracts which for some time have been among my collection of clippings might be of interest to your readers in this same connection.

From the *Proceedings of the Liverpool Naturalists Field Club*—1904, page 30:

> Soon shall thy arm unconquered stream afar,
> Drag the slow barge or drive the rapid car,
> Or on wide waving wings expanded bear
> The flying chariot through the fields of air.
>
> —ERASMUS DARWIN, 1802.

In a publication by the Rockefeller Center, it was reported that George J. Atwell has brought to light the following inscription from the tombstone of Saint

Francis of Paula, 1416–1508, in Kirby Cemetery in Essex, England:

When pictures look alive with movements free;
When ships, like fishes, swim beneath the sea;
When men outstripping birds shall scan the sky;
Then half the world, deep-drenched in blood, shall die!

WILLIAM H. CREW

195 BROADWAY,
NEW YORK, N. Y.

SCIENTIFIC BOOKS

PLANTS AND VITAMINS

Plants and Vitamins. By W. H. SCHOPFER, director of the Botanical Institute, University of Bern. Authorized translation by N. L. Noecker. xiv and 293 pp. Foreword by W. J. Robbins. Waltham, Mass.: The Chronica Botanica Company. New York City: G. E. Stechert and Co. 1943. $4.75.

TEN years ago no book could have been written about vitamins in plants, although plants were clearly recognized as an important source of accessory factors for human and animal nutrition. During the last decade extraordinary progress in the study of vitamins has resulted in a rich literature which supports the ambitious goal which the author of "Plants and Vitamins" has undertaken, namely, to crystallize our knowledge of vitamins in plants, to show the relations of this domain to general biochemistry and physiology and to suggest fertile areas for cultivation by future investigators. The book contains 24 chapters, an author index and a general index, and many illustrations and structural formulae of compounds.

The contents are organized into three parts. The first deals with the capacity for synthesis and the functions of vitamins in green autotrophic plants. In the second part, the author gives an extensive discussion of growth factor deficiencies in organisms which have lost the ability to synthesize vitamins. Part three presents some general phenomena which are wholly or partially explained on the basis of the vitamin concept. Well-deserved emphasis is given to the discussion of growth factors in microorganisms, because it is in this particular field that outstanding progress has been made in such a short time. Of special interest to both plant and animal physiologists are the chapters on biological synthesis and the roles of growth factors in protoplasm. The discussion of vitamins in enzyme systems could have been more extensive, and much remains to be said about competitive inhibition, sulfonic analogues, etc.

As stated by the author, his book does not by any means claim finality, but rather represents a stage of progress in research which continues to advance. Although some workers may not wholly agree with certain of the author's conclusions and the emphasis placed upon various topics, this book fills the need for a critical and authoritative appraisal of the advancement of our knowledge concerning vitamins in plants. The writing of such a book required the consultation of a very extensive bibliography. It is a matter of regret that many interesting and important contributions mentioned briefly in the discussion are not cited by specific references to the literature. It is easy, however, to forgive omissions of literature published since 1941, when one considers the difficult circumstances surrounding the author in Switzerland.

Only in the past several years have we learned that the fundamental functions of vitamins are the same in regulating the metabolism of both plants and animals. A vitamin, according to Professor Schopfer, is an "organic substance, the need for which results from the loss of the capacity for its synthesis, whose action is catalytic (active in small amounts), quantitative and markedly specific." The book indicates that at all phylogenetic levels the requirements of living matter are approximately the same regardless of the structure of the organism. The only aspects that differ are the morphological expressions to which vitamin deficiency may give rise. The author shows how vitamins constitute the meeting ground for specialized sciences, where workers in organic chemistry, enzymology, human, animal and plant physiology all meet to solve fundamental problems.

The philosophical view-point of the author is indicated in the following quotations taken from his concluding chapter:

> In order to understand the problem of vitamins in all of its ramifications it is no longer possible to confine oneself to one field. The plant physiologist has learned from his confrère, the human physiologist, what an avitaminosis and a vitamin is. The plant physiologist in turn has shown that plants are the seat of the biosynthesis of vitamins and thus has established a new intimate relationship between two kingdoms. The biochemist, by establishing the chemical structure of vitamins, has been obliged to create new groups of chemical compounds. The enzymologist finds to his surprise that these vitamins are nothing but the active portions of enzymes which have been studied for a long time. The microbiologist, who for years had been trying, without success, to isolate the "growth factors" of his microorganisms, proved that typical animal vitamins were the factors he was looking for. The concept of growth factors (in the exact sense) conforms with that of vitamins (in the strict sense) and is identical with it. . . .
>
> The problem of vitamins started with man and, in the last analysis, it returns to man after an apparent departure from him. All the progress accomplished in this domain contributes to a better understanding of the prob-

lem in general and ultimately to human well-being. To speak of the well-being of Man at this time seems to be macabre humor. Why is it that skillful men from different nations can solve problems in fundamental biology but can not do so when the matter directly concerns themselves? The question remains unanswered.

PAUL R. BURKHOLDER
YALE UNIVERSITY

REPORTS

A DEPARTMENT OF GEOGRAPHY[1]

AT least a hundred college heads have inquired as to our plans for geography in the post-war years and have invited help in the selection of personnel. This is true no less of women's colleges than of men's colleges. It shows deep and, we hope, permanent interest in research as well as thorough-going instruction in geography. This has been one of the most neglected fields in higher education. War and its related problems of peace-time organization for equity and freedom have at last taught the American people that modern geography is not children's geography to be finished in the seventh grade. That "imaginative grasp of space" which science shares with poetry seemed somehow to have been impossible to attain until our Army, Navy and Air forces had taken their stations and begun their operations in almost every part of the world. For a full generation we seemed unable in our thinking to synchronize time and space in a spreading network of technologies, trade and international relations. "The Map and the Clock" is the significant title of a brilliant editorial published recently in the London *Times Literary Supplement*. We shall be dealing with what we once regarded as the "outer world" for a long time to come, with such speed and responsibility, and with such a practical need for wide comprehension, that we can not escape corresponding educational demands if we would.

Geographical science has a significant part to play in national policy. The conviction seems to grow that we can not safely limit our future responsibilities to narrow zones of power. No line can be established anywhere in the world that confines the interest of the United States because no line can prevent the remote from becoming the near danger. Nor can danger be wished or talked away. Positive intentions and acts based upon deep understanding of both good and evil forces are required. The Western Hemisphere conferences of the past ten years are but one of several major forms of political association. This geographical term no longer implies political separation from the rest of the world and a sheltered retreat. Interwoven with the fate of the United States are the fates of countries on the farther side of the world organized on political and social hypotheses and conditions quite different from those that prevail among ourselves.

For nearly one hundred and fifty years the philosophy of geography has included the thesis of Humboldt, that the diversified riches of the earth are a vast source of human enjoyment, and that man's highest development requires that we put the world's resources into a common world stream of understanding and use. We have become so accustomed to international trade that we are often insensible of the extent to which our comfort, our welfare and our safety depend upon the interchanges of products and ideas about them and the multiform agreements that implement their exchange.

More important still is the process of cultural interchange. If it were as free and full to-day as our exchange of products, the world, while retaining its picturesque and stimulating cultural differences, might have an agreed code of relationship and behavior with corresponding reduction of the risk of war. It will take further experience, long-continued persuasion and a determined will to bring such a code into being. Certainly ignorance and flippancy will not build a highway to this goal. We must gain experience and will power on a higher level of cultural interrelations than any we have yet known. This means knowing other peoples intimately, and gaining the ability to see their interests clearly as well as our own. Only in their natural settings can we fully understand the languages, literatures, codes, ideas, interests and moralities of peoples unlike ourselves. To give but one example, no policy of interrelated migration of people and of settlement of underdeveloped lands, no rational easement of so-called "population pressure," can be sound unless and until geographical and cultural studies are joined in the attainment of agreed purposes. Such great endeavors also require the union of the philosophical and the utilitarian, the theoretical and the practical. The result is of such profound consequence to a stable world order that it would be madness to exclude university participation. Only during the past two decades have some of our universities become aware of their long neglect of fields of inquiry and action that affect the peace or the ruin of the diverse peoples that share the planet. Once an honored part of the classical curriculum—Ptolemy, Strabo and Varenius having been almost as well and as generally known by educated men of an earlier generation as Virgil and Homer—geographical instruction declined in the nineteenth century and even at the time of World War I was limited to a relatively small number of universities.

For several years we have been giving instruction in geography at Hopkins on a modest scale. The Army Specialized Training Program has required the

[1] From the annual report of Dr. Isaiah Bowman, president of the Johns Hopkins University.

dden expansion of instruction in this field at a time hen it is extremely difficult to increase staff because the prior demands of the armed services. It is atifying to report that the faculty enthusiastically vors the development of a permanent department in e interest of both undergraduates and graduates. illing cooperation in this enterprise is evidence of a althy attitude toward post-war conditions which initably will have more of the planetary in them even no less of the local and national.

To have depth and university quality such a department must have a staff of exceptionally well-trained holars. To secure breadth there should be active sociation, in this new training program, among holars in a number of related or parallel fields.

Four young men of excellent training form the core the department. They are Dr. Karl J. Pelzer, who as already published extensively on settlement and bor conditions in the Far East; Dr. George Carter, hose work in both geography and anthropology proides a useful link between these two fields, and who ill provide specific instruction in the latter field in his university for the first time; Dr. Andrew Clark, ho has had two years' field experience in the Pacific rea; and Dr. Jean Gottmann, formerly of the Institut de Géographie, University of Paris, who began his ssociation with Hopkins in April, 1943, thanks to eave from the Institute for Advanced Study, and who ill join our faculty on a full-time basis on July 1, 1944.

To assist the members of the Department of Geography and to provide the requisite breadth, the cooperation of a number of scholars in allied fields has been obtained. The archeological and cultural aspects of Mediterranean geography will be developed by Dr. W. F. Albright, whose distinguished work in Near Eastern archeology and history is well known. The historical and regional geography of the Basin will be developed by Dr. Gottmann. A course on the geography of disease will be worked out cooperatively with the School of Hygiene and Public Health. The Far Eastern field will continue to have the guidance of Mr. Owen Lattimore, director of the Page School of International Relations, and more recently political adviser to the Chinese Generalissimo. The wide experience of Dr. Abel Wolman, professor of sanitary engineering, will be available for advanced work in the vital field of conservation. Associated with the department is Mr. Lloyd Brown, librarian of the Peabody Institute, who will give instruction in historical geography, a field in which he has already made notable contributions. We will also continue to have the cooperation of Dr. Ernst Cloos and other members of the Department of Geology in the training of students in physiography and meteorology. I am pleased to note also the interest and friendliness of the History Department, the English Department and others.

These interconnections are not imposed upon any department. They register the general belief that the university should enrich its program of academic instruction, not only by the addition of a formal department of geography, but also by a certain grouping of established interests and training skills in different fields of research. We shall thus have better trained men in existing departments while providing a larger number of competently trained young geographers to help staff the many new departments of geography now in the making throughout the United States.

Finally, we have a great work of conservation and development before us as a nation. We can not expect high cultural attainments on a mean or low material basis. The world is rich but its wealth is finite not infinite. The most advanced countries have been most wasteful of their patrimony. Only a few have but recently adopted more sensible conservation policies, and they have still far to go. In the colonial field we have terrible examples before us of downright failure in applying our more intensive cultural methods to native enterprise and unfamiliar tropical environments under the stimulus of commercial agriculture. It would be folly to expect every people, and especially the small and poor, to discover and adopt sound conservation practices. The leading nations have great technical staffs and vast opportunities of experimentation through mass education that smaller nations do not possess. But colonial administrators and policy-makers, to secure adequate staffs for the enlarged tasks of the future, will need far more penetrating and advanced geographical instruction than anything we have known up to this time.

A large expansion of research and of technological training is implied by such a program. A considerable amount of it will invite the participation of women as well as men. Cartography alone has been stimulated enormously by the war, and it will continue to be a major concern of enterprising government departments after the war. Through it, and its many applications, national inventories of resources may be properly taken, land registers completed, and statistical results given that environmental framework that good public administration requires. Meteorological and climatological research as well as the environmental study of disease, greatly intensified, would benefit hundreds of millions of people in areas that hitherto have had altogether inadequate services. We now see that the welfare of others is our welfare also, for without mutual advantage there is, in the long run, no advantage at all for any one.

Geographical inquiry is deeply concerned with the

interplay of cultural and environmental forces. Environments are not properly appraised in terms of arithmetic only, such as statistics about soils of ascertained natural fertility, combined with statistics showing seasonal variations of rainfall and temperature. The natural aptitudes of peoples count greatly. Necessity and will also drive men to change their ways and to do the unexpected and even the uneconomic. Migrations still play their vital role. In one country of the Western Hemisphere a foreign element of 260,000 Asiatics, among a group of 6,000,000, now control certain economic activities so largely that their ejection would threaten economic ruin. The causes of such instances require identification. Post-war economic necessities will drive every country to inventory its resources and develop them more intensively, tighten economic administration, and see geographical relations more clearly than ever before. These are the indispensable preliminaries of sound national policies.

SPECIAL ARTICLES

SEROLOGICAL REACTIONS WITH AN INDIFFERENT STREPTOCOCCUS IN PRIMARY ATYPICAL PNEUMONIA[1,2,3]

AN indifferent streptococcus (No. 344) was isolated recently from the lung of a fatal case of primary atypical pneumonia. Convalescent sera from patients with this disease were found frequently to possess the capacity to agglutinate this bacterium, while, in most instances, agglutination did not occur with acute-phase sera from the same patients, with the sera of normal individuals or with the convalescent sera of patients with certain other acute infectious diseases. Moreover, convalescent sera from some patients with primary atypical pneumonia yielded precipitates when mixed with soluble substances extracted from this micro-organism, while control sera did not.

Streptococcus 344 was isolated by the inoculation of a suspension of tissue from a human lung into the yolk sacs of chick embryos. It was readily cultivated on blood agar or in beef infusion broth, and grew well under aerobic or anaerobic conditions. On blood agar, small, gray, coniform colonies with slightly serrated surfaces were produced. No hemolysis occurred during 48 hours' incubation on blood agar prepared from rabbit, sheep or human blood. Suspensions of this organism were not soluble in bile. Fermentation reactions, in preliminary tests, did not serve to differentiate this bacterium from other indifferent streptococci.

Bacterial suspensions for agglutination tests were prepared from 24-hour cultures in broth. The bacteria were sedimented, washed three times with saline solution, killed by heating at 56° C. for 30 minutes, and resuspended in saline solution so that the turbidity approximated No. 5 in the McFarland series. Two-fold dilutions of unheated serum in saline solution were mixed with equal volumes of the suspension. The final dilutions of serum ranged from 1:10 to 1:160. Tests were not carried out with serum dilutions of less than 1:10, since it was found that the bacterial suspension often agglutinated in 1:2 and occasionally in 1:4 dilutions of normal serum. Following 2 hours at 37° C. and 18 hours at 4° C. the tubes were shaken and readings were made.

Agglutination tests were performed with sera from 101 patients with primary atypical pneumonia. Sera were obtained during the acute phase of the disease and at varying periods in convalescence. Similar tests were made with acute and convalescent sera from patients with acute respiratory infections without pneumonia, psittacosis, pneumococcus pneumonia, influenza A, scarlet fever and other severe streptococcus infections. The sera of 50 normal individuals were also tested.

The results of these tests are shown in Table 1. The convalescent sera of 55 patients with primary atypical pneumonia agglutinated streptococcus 344 at dilutions ranging from 1:10 to 1:160. On the other hand, the acute-phase sera from the same patients did not cause agglutination of this bacterium except in 3 instances, in which positive reactions occurred at 1:10 dilutions. The sera from patients with pneumococcus pneumonia were negative in this test, as were also the sera from patients with psittacosis, scarlet fever and influenza A. The convalescent sera of 2 patients with acute respiratory infections without pneumonia showed titers of 1:10. One patient with Group F minute beta hemolytic streptococcus empyema developed a serum titer of 1:40 and the serum of another patient with subacute bacterial endocarditis caused agglutination at a dilution of 1:80. All the sera from 50 normal individuals failed to produce agglutination under the conditions of this test.

In the majority of instances, positive agglutination

[1] From the U. S. Navy Research Unit at the Hospital of The Rockefeller Institute for Medical Research, New York, N. Y.

[2] The Bureau of Medicine and Surgery of the U. S. Navy does not necessarily undertake to endorse views and opinions which are expressed in this paper.

[3] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and The Rockefeller Institute for Medical Research.

TABLE 1

RESULTS OF AGGLUTINATION TESTS WITH STREPTOCOCCUS 344 AND HUMAN SERA

Diagnosis	Number of patients	Serum	Agglutination titer of serum					
			<1:10	1:10	1:20	1:40	1:80	1:160
			Number of patients with indicated titer					
ypical pneumonia	101	Acute	82	3	0	0	0	0
		Conval.	46	31	14	4	4	2
ute resp. infection	20	Acute	20	0	0	0	0	0
		Conval.	18	2	0	0	0	0
ittacosis	4	Acute	4	0	0	0	0	0
		Conval.	4	0	0	0	0	0
neumococcus pneumonia ..	28	Acute	28	0	0	0	0	0
		Conval. ...	28	0	0	0	0	0
fluenza A	12	Acute	12	0	0	0	0	0
		Conval.	12	0	0	0	0	0
arlet fever*	10	Acute	10	0	0	0	0	0
		Conval.	10	0	0	0	0	0
reptococcus† infection ...	2	Acute	1	0	0	0	0	0
		Conval.	0	0	0	1	1	0
ormal	50	....	50	0	0	0	0	0

* Scarlet fever due to Group A hemolytic streptococcus Type XIX.
† 1 patient with subacute bacterial endocarditis. 1 patient with empyema due to group F beta hemolytic streptococcus.

eactions were encountered with sera obtained during he second or third week after the onset of primary typical pneumonia. Maximum titers were found sually during the third or fourth week, and a sharp diminution in titer frequently occurred during the fifth or sixth week. In many cases the ability of patients' sera to cause agglutination rapidly disappeared, although in some instances agglutination was still caused by sera collected 10 weeks after onset. There appeared to be a positive correlation between he severity of the illness and the development of gglutination reactions with streptococcus 344.

Soluble substances were obtained from concentrated suspensions of the streptococcus by acid extraction at 100° C. and precipitation with alcohol, after which the precipitate was dried and then taken up in saline solution. The procedure was similar to that utilized for the preparation of "M" extracts from beta-hemolytic streptococci.[4] When dilutions of water-clear extracts were mixed in capillary pipettes[5] with convalescent sera from selected patients with primary atypical pneumonia, flocculent precipitates were formed after 2 hours at 37° C. and 24 hours at 4° C. No precipitation occurred with acute-phase sera from the same patients or with normal human sera. Preliminary tests indicate that the results of this test parallel those of the agglutination test but that the precipitin method is less sensitive.

Complement fixation has not been demonstrable with convalescent sera and streptococcus 344, although tests were made with antigens which gave positive reactions in either the precipitation or the agglutination tests.

[4] R. C. Lancefield, *Jour. Exp. Med.*, 47: 469, 1928.
[5] H. F. Swift, A. T. Wilson and R. C. Lancefield, *Jour. Exp. Med.*, 78: 127, 1943.

Convalescent sera which had been heated at 60° C. for thirty minutes were found to have lost almost completely their capacity to agglutinate this bacterium. Heating sera at 56° C. however did not alter the titer. Sera stored at 4° C. for 1 year still gave positive reactions. The bacterial antigen was not impaired by heating at 100° C. for 10 minutes, by 0.5 per cent. phenol, or by storage for 1 month at 4° C.

The results of the streptococcus agglutination tests were found to be correlated in many instances with the results of the cold hemagglutination test[6,7] as well as with the results of the complement-fixation test with mouse lung antigens[8] previously described. However, an appreciable number of convalescent sera were encountered in which only one or two of these tests were positive.

In preliminary experiments the cold hemagglutinin was completely absorbed from a pool of convalescent sera by human red cells without reducing the agglutination titer against streptococcus 344. Conversely, absorption of the pool with this bacterium removed the agglutinin against itself but did not decrease the titer of cold hemagglutinins.

Recently another indifferent streptococcus (No. 9) was isolated from the lung of a second fatal case of primary atypical pneumonia. The results of both agglutination and precipitation tests with this organism were comparable to those observed with streptococcus 344.

Numerous other strains of indifferent streptococci have been isolated which resemble streptococcus 344,

[6] O. L. Peterson, T. H. Ham and M. Finland, SCIENCE, 97: 167, 1943.
[7] J. C. Turner, *Nature*, 151: 419, 1943.
[8] L. Thomas, E. C. Curnen, G. S. Mirick, J. E. Ziegler and F. L. Horsfall, Jr., *Proc. Soc. Exp. Biol. and Med.*, 52: 121, 1943.

morphologically and culturally. These were obtained from the throats or sputa of patients with primary atypical pneumonia, as well as from persons with other acute respiratory infections without pneumonia. As yet, none of these strains has yielded results similar to those obtained with streptococcus 344 in agglutination tests. Agglutination has either failed to occur or has occurred to an equal degree in both acute-phase and convalescent sera. However, when some of these strains were extracted, it was found that soluble substances were obtained which gave results very similar to those observed in precipitation tests with streptococcus 344.

There is as yet no satisfactory explanation for the positive serological reactions which have been observed with streptococcus 344. The available evidence does not warrant the conclusion that this bacterium is a factor in the etiology of primary atypical pneumonia.

LEWIS THOMAS, LT.
GEORGE S. MIRICK, LT.
EDWARD C. CURNEN, LT.
JAMES E. ZIEGLER, JR., LT.
FRANK L. HORSFALL, JR., LT. COMMANDER
U. S. NAVAL RESERVE

THE ADRENALS AND SUSCEPTIBILITY TO TRANSPLANTED LEUKEMIA OF RATS

IT was demonstrated some years ago by Jaffe[1] that removal of the adrenals was followed by regeneration of the thymus in old rats and a stimulation of the gland in young rats. A transplantable lymphatic leukemia under investigation in this laboratory has as its most characteristic manifestation an extensive infiltration of the thymus.[2] In the investigation to be reported, the effect of adrenalectomy with its accompanying stimulation of the thymus has been tested on the susceptibility of rats to inoculated leukemia.

Two groups of experiments have been completed. The object of the first was to determine the result of adrenalectomy on the leukemia susceptibility of middle age rats, this being an age when normally the thymus has almost completely atrophied. Even the most receptive strain of rats at this age show a natural resistance, as illustrated by the fact that only 46.9 per cent. of 32 inoculated animals developed the disease. As a contrast to this, rats of the same age and strain subjected to adrenalectomy 15 days before inoculation developed leukemia in 90.3 per cent. of the 31 rats included in the group. The average survival time of the intact rats with the disease was 9.7 day, whereas the adrenalectomized animals averaged only 6.2 day.

[1] H. L. Jaffe, *Jour. Exper. Med.*, 40: 325–342, 1924; 40: 619–625, 1924; 40: 753–760, 1924.
[2] J. B. Murphy and E. Sturm, *Cancer Research*, 1: 379–383, 1941.

In the second group of experiments tests were ma of the effect of adrenalectomy on induced resistance young rats. This state may be brought about by t injection of homologous defibrinated blood two wee prior to inoculation.[3] In experiments involving 2 rats the following results were recorded. Intact you rats which received the blood injection alone develope leukemia in only 33.9 per cent. of the 59 inoculate Among the 43 rats adrenalectomized before the inje tion of defibrinated blood 76.8 per cent. were suscep tible and in 42 rats subjected to the reverse procedure *i.e.*, the blood injection preceding the removal of t adrenals, 92.9 per cent. developed the disease followin inoculation. Control rats which received no treatmen before inoculation were 96.5 per cent. receptive, an untreated adrenalectomized inoculated rats all died o the disease.

Certain hormones are known to influence malignan conditions in such organs as are normally subject t control by the individual hormone. While in genera it is not justifiable to draw conclusions as to the origi of a malignant state from results of a study of trans plantation, yet in the present case it may not be amis to call attention to the fact that the activity of th lymphoid tissue can be influenced by hormones. There fore it is not unlikely that such hormones play a rol in the malignant condition of this tissue, and this like lihood is suggested by the reported results. More direc evidence of this possibility is being accumulated from an extension of the investigation.

JAMES B. MURPHY
ERNEST STURM
ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

LOW LIGHT INTENSITY AND COTTON BOLL-SHEDDING

MANY reasons have been given for the shedding of flower buds (squares) and immature bolls by the cotton plant. Aside from insect injury, such factors as drought, fluctuations in soil moisture, impaired fertilization in the flower and load of fruit on the plants have all been shown to be related to the problem of excessive shedding. The studies of Mason[1] in the West Indies and those of Knight[2] in the Sudan, as well as the paper by Canney,[3] suggest that periods of cloudy weather may have considerable effect on the fruiting and shedding of cotton.

In studying the causes of shedding in cotton, recent experiments at the Texas Agricultural Experiment Station indicate that interruptions for two or three days in the high sunlight intensities often causes undue shedding of fruiting forms. For example,

[3] E. Sturm, *Cancer Research*, 1: 627–628, 1941.
[1] T. G. Mason, *Annals Bot.*, 36: 457–484, 1922.
[2] R. L. Knight, *Empire Jour. Exp. Agr.*, 3: 31–40, 1935.
[3] E. E. Canney, *Shirley Inst. Memoirs*, 3: 281–290, 1924.

pland cotton plants in jars of soil two months after lanting were subjected to low daylight intensity of round 50-foot candles by keeping the plants in a laboratory room for a single 4-day period. Five eeks later, these plants had on the average only 5.4 ood-sized bolls per plant and each plant had shed an verage of 30 squares and young bolls. At the same ime, the control plants had 21.2 bolls per plant with nly 17.5 squares and bolls shed. This represents a eduction of 75 per cent. in the number of mature olls, associated with the low light intensity treatment. Most of those fruiting forms were shed during the hird and fourth days while the plants were indoors. Similar increases in rates of shedding have been obained by shading cotton plants in the greenhouse and n the field with black cloth. Such shading has reduced the direct sunlight intensity at midday from round 12,000 foot candles to 300–1,000 foot candles. n connection with these studies at College Station, ight intensities of less than 1,000 foot candles have been measured at noon on cloudy days during the growing season for cotton.

In addition to the abscission of young bolls just after flowering, at which stage most of the shedding in the field takes place, these low light intensities for as short a period as two days caused the shedding of many cotton squares. These effects are equal to results obtained by prolonged severe wilting, which is recognized as providing a strong stimulus for shedding. Presumably, the accelerated rates of shedding following shading were associated with interrupted photosynthetic activity and low carbohydrate nutrition. Increased vegetative growth followed the shedding of buds and bolls.

Evidence of varietal differences in the response of cotton to conditions of low light intensity has been obtained.

A. A. DUNLAP

AGRICULTURAL EXPERIMENT STATION,
AGRICULTURAL AND MECHANICAL COLLEGE
OF TEXAS

SCIENTIFIC APPARATUS AND LABORATORY METHODS

USE OF ENZYMES TO IMPROVE CYTOLOGICAL TECHNIQUES

DURING the last few years cytological studies on a tetraploid form of *Lilium longiflorum* Thunb. have been in progress at the Plant Industry Station, Beltsville, Md. It was found very difficult to analyze chromosome associations during the first meiotic metaphase because they tended to form clumps. To overcome this difficulty a number of treatments designed to digest the cell wall and destroy the gel properties of the cytoplasm were used. If this could be accomplished without injury to the paired chromosomes, well-spread figures could be secured in which analysis of polyvalents would be possible. Among the treatments herein described, several with enzymes gave definitely beneficial results.

The plants used for these experiments were a tetraploid clon of *Lilium longiflorum*, several diploid forms of the same species and a triploid clon of *L. tigrinum* Ker Gawler. Buds were collected in which most of the pollen mother cells were at the first meiotic metaphase. The perianth segments were removed and the buds then fixed in a solution composed of 3 parts absolute alcohol to 1 part glacial acetic acid. After overnight immersion the buds were run through 95 per cent. alcohol to 70 per cent., where they were held until wanted.

The anthers, as needed, were cut into small pieces, about 1 to 2 mm long, thus making it possible to give a series of different treatments to portions of the same anther. All slides were stained with aceto-carmine.

In the first series of tests only inorganic chemical treatments were used. These were: a cellulose solvent, copper oxide ammonia; a pectin solvent, 1 per cent. ammonium oxalate; and a suberin solvent, 10 per cent. alcoholic potassium hydroxide. All the slides from the treatments were poor in comparison with the untreated.

These unsatisfactory results led us to try a biological approach, and 1 per cent. solutions of three enzyme preparations were tried: Malt diastase; Polyzime "P," which is used in desizing fabrics; and Clarase,[1] a proprietary enzyme complex. For these treatments the fixed anthers were first run through lower strengths of alcohol to water and thoroughly washed. Use of the first two preparations produced little if any benefit in comparison with the check slide which in this instance was made following the washing in water. The Clarase treatment, however, brought about a partial softening of the cell walls and digestion of the cytoplasm so that in most cells the paired chromosomes were well spread out, thus making it possible to determine the types of chromosome associations present. Several periods of exposure were tried and as little as 15 to 20 minutes was about as effective as several hours.

Since the diastatic enzymes were ineffective it was thought that possibly the beneficial effects of Clarase

[1] Manufactured by the Takamine Laboratory, Clifton, N. J.

might be caused by a proteolytic enzyme. Accordingly, 1 per cent. solutions of pancreatin (supplied by the makers of Clarase), and of papain were used. Both preparations were ineffective, and actually caused chromosome clumping. The results were very poor when compared with the checks.

Recent studies by Greathouse, Klemme and Barker[2] on the deterioration of cellulose by fungi, suggested that certain of these organisms might be of value in the present problem. Fortunately we were able to secure cultures of *Aspergillus niger* Van Tieghem, *Chaetomium globosum* Kunze, and a species of *Metarrhizium* through the courtesy of G. A. Greathouse of this Bureau. Single flask cultures were extracted 10 to 15 days after inoculation by grinding the contents of the flask with quartz sand in a mortar containing 10 ml of a sodium acetate buffer, pH 5.0. The supernatant liquid was tested on anther sections as previously described for the enzymes. This series of treatments also included a 5 per cent. solution of Clarase in sodium acetate at pH 5.0. All treatments gave beneficial results and produced slides superior to the checks. The cell walls of most pollen mother cells were softened and the cytoplasm partially digested. As a result of these changes the cells were easily flattened and the chromosomes spread. Tests were also made in which the freshly prepared Clarase solution and fungus extracts were heated to boiling prior to use. The slides resulting from material treated in the boiled solutions were definitely inferior to those from the unheated solutions, which indicates that active enzymes were necessary to produce the beneficial effect.

The results herein briefly reported are preliminary to further work under way with other treatments and modes of application. There are many aspects of the problem needing further investigation. For instance, it is not possible as yet to measure the concentration of the fungus extracts used, or to identify the enzyme or enzyme complex that is effective. So far the method has been used on only one species other than Lilium. Dr. A. E. Clarke of this division has used Clarase on the pollen mother cells of an amphidiploid Allium with beneficial results. Some observations have also been made on smears of treated Lilium root tips. These have shown that fungus extracts affect the middle lamella so that the cells separate readily. Further investigations of pre-treated root-tip smears are under way.

NEIL W. STUART
S. L. EMSWELLER

BUREAU OF PLANT INDUSTRY,
SOILS AND AGRICULTURAL ENGINEERING,
U. S. DEPARTMENT OF AGRICULTURE,
BELTSVILLE, MD.

[2] G. A. Greathouse, D. E. Klemme and H. D. Barker, *Ind. and Eng. Chem. Anal. Ed.*, 14: 614–620, 1942.

A NYLON BLOOD AND PLASMA FILTER

FOR the last nine months we ran laboratory tests on Nylon blood and plasma filters. Our observations and tests fully coincided with those made by Dr. S. Brandt Rose, *et al.*, as reported in SCIENCE (Vol. 98, No. 2534).

However, we found the sewing of these tiny filters rather cumbersome, and noted that small, but objectionable quantities of Nylon fibers would be entrained in the filtrate.

We took advantage of the thermo-plastic qualities of Nylon and welded the seams rather than sewing them. This method is much faster than sewing and eliminates the shedding of Nylon fibers. Furthermore, the filters can be fabricated with a cone point, and thereby can be utilized for making the drip count.

The following method was found to be satisfactory in making the filters: A double layer of finely textured Nylon cloth was placed on a flat metallic surface. A sheet metal template was made for the filters, and this was placed firmly over the Nylon cloth. The outline of the template was then traced with an electrically heated metal stylus. The stylus of an electric wood-burning set was used for this with excellent results. Flat, colorless, flexible seams were obtained after only a small amount of practice. These seams were tested carefully and were found to be safer for use in transfusion filters than sewn ones.

Prior to using the electric cutting method, experiments with flame cutting were conducted, but the results were found to be too unreliable.

The filters were welded directly to the glass delivery tube of the transfusion assembly.

Some chemical tests were made on the Nylon material. It was found to be soluble in mineral acids and was destroyed by alkalies. It withstood treatment with hydrogen peroxide and solutions of sodium citrate and sodium citrate-dextrose.

The apparatus was developed in the laboratory only, and was not used in giving transfusions to patients.

ELIZABETH GLASER
LOS ANGELES, CALIF.

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